



ESSAS

(Ecosystem Studies of Sub-Arctic Seas)

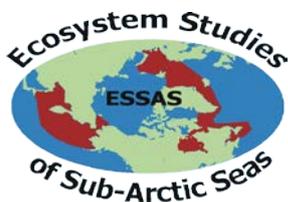
Scientific Steering Committee

Report

of the

2011 Annual Meeting

Seattle, Washington, USA
Marriott Waterfront Hotel
27 & 28 May, 2011



Compiled by

Margaret M. McBride, Ken Drinkwater, and Franz Mueter

September 2012

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1. Participants

SSC Members in Attendance

Ólafur Astthorsson	Iceland
Enrique Curchitser	USA
Earl Dawe	Canada
Ken Drinkwater	Norway
Erica Head	Canada
George Hunt	USA
Franz Mueter	USA
Jim Overland	USA
Yasunori Sakurai	Japan
Kai Wieland	Greenland/Denmark

SSC Members Unable to Attend

Hyung-Cheol Shin	Korea
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Invited Guests

Alexander Bychkov	Canada
Keith Criddle	USA
Seth Danielson	USA
Jackie Grebmeier	USA
Adi Kellermann	Denmark
Skip McKinnell	Canada
Marit Reigstad	Norway
Mike Sigler	USA

ESSAS Project Office

Margaret M. McBride	Norway
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Contact Information for the participants is listed in Appendix 1.

2. Introduction and Adoption of Agenda

The 2011 annual meeting of the ESSAS Scientific Steering Committee (SSC) was held on 27-28 May at the Seattle Waterfront Marriott Hotel in conjunction with and directly following the ESSAS 2011 Open Science Meeting (22-26 May). Ken Drinkwater, ESSAS Co-chair, opened the meeting by welcoming the SSC members and guests who were specially invited to discuss the future direction of ESSAS science. The meeting agenda was adopted as presented and appears in Appendix 2.

This SSC meeting was the last with Dr. George Hunt as Co-Chair of ESSAS. Dr. Franz Mueter, a quantitative fisheries ecologist from the Juneau Center of the University of Alaska, Fairbanks, takes over as Co-Chair from the Pacific, and Dr. Drinkwater remains as Co-Chair from the Atlantic. All ESSAS SSC members thanked George for his untiring work on behalf of ESSAS during the past 9 years, including 3 years leading the push to establish ESSAS and having it recognized as a GLOBEC regional program, and 6 years initially as Chair and then as Co-Chair since ESSAS's formal inception in 2005. Thankfully, George will remain on the SSC as an *ex-officio* member and will work toward its continued success. The SSC also welcomed Franz and looks forward to working with him in the coming years.

3. Adoption of 2010 Meeting Report

A motion to adopt the 2010 SSC meeting report passed unanimously.

4. Follow-up from 2010 Meeting

Margaret McBride reviewed the status of the action items for the SSC members from the 2010 annual meeting. All action items were followed up.

5. OSM Outcomes

George Hunt gave a short report on the OSM and its outcome. The meeting was considered successful with several participants commenting on the quality of the science and their appreciation of the participation of the students from the Pribilof Islands, the musical presentation by Science Fair, and the wrap up summary of the workshops and the parallel sessions near the end of the meeting. Primary publication of some of the results from the OSM will appear in several special issues of scientific journals.

- Papers from several of the theme sessions will appear in a dedicated ESSAS volume of the ICES Journal of Marine Science. This special issue will be dedicated to our colleague and good friend Dr. Bern Megrey, a long time member of the ESSAS SSC and co-leader of the Working Group on modeling, who unfortunately passed away unexpectedly last October.
- Papers from the session on gadid-crustacean interactions will appear together in a special section of Marine Ecology Progress Series (MEPS).
- Papers from the Bering Sea session will appear in a special issue of Deep Sea Research II.
- The Journal of Marine Systems will be approached to publish a special issue composed of papers from the modeling session and, if accepted, this issue will also be dedicated to the memory of Bern Megrey.

ACTION: George Hunt (USA), Ken Drinkwater (Norway), Erica Head (Canada) and Olafur Astthorsson (Iceland) will handle the editorial duties for the ICES Journal.

ACTION: Enrique Curchitser is to write a proposal to Wolfgang Fennel (Editor-in-Chief) for a special issue of the Journal of Marine Systems to publish papers from the modelling session of the OSM.

ACTION: Ken Drinkwater will write a report on the OSM for the PICES Press.

ACTION: George Hunt will write a letter of appreciation to the OSM sponsors.

6. Working Group Status Reports

The former WG1 (Regional Climate Predictions) and WG2 (Biophysical Coupling) have concluded their work. As a result, and to avoid confusion in the future, we have decided to drop the number designation for the working groups and will simply refer to them by name.

6.1 WG on Modeling Ecosystem Response (WGMER, formerly WG3)

2010-2011 Activities

This working group convened a session entitled “*Modeling marine ecosystem dynamics in high latitude regions*” at the ESSAS 2011 OSM to highlight different approaches to modeling the impacts of climate variability on high latitude marine ecosystems and their ability to support sustainable ecosystem services. A total of 12 talks and 6 posters were presented on different types of models from minimalist to end-to-end models. Invited speakers included:

- Diane Lavoie (Canada) who discussed different types of models used in her study of climate change and variability on productivity of the Beaufort Sea in the Arctic and the Gulf of St. Lawrence in eastern Canada. In the former region, a 1 dimensional NPZD model was used to develop future scenarios of primary production while in the latter region dynamical downscaling was used.
- Dag Slagstad (Norway) presented results from a coupled biophysical model of the Barents Sea and the Arctic. A northward shift in the distribution of *Calanus* species is predicted but *C. finmarchicus* is still not expected to inhabit the Arctic Ocean year around. Increased stratification in the Norwegian and southern Barents Sea will limit nutrient replenishment and primary production in these regions.
- Takeshi Okunishi (Japan) presented an Individual Based Model (IBM) for the Japanese sardine. He was able to simulate the observed transport of eggs and larvae as well as the feeding location of the juveniles in a region of high chlorophyll concentrations.

Two other IBM studies were presented:

- Trond Kristiansen (Norway) found from his IBM model that increased temperatures under climate change would product a negative effect on the growth and survival of Atlantic cod larvae in the southern regions of its distribution but a positive effect in the north.
- Frode Vikebø (Norway) used an IBM to investigate herring recruitment in the Norwegian Sea, and concluded that the distribution of larvae depends significantly upon the vertical distribution and hatching date.

Statistical models of the observed variability in fish and invertebrate abundances in the eastern Bering Sea were also presented.

- Mary Beth Decker (USA) suggested that food availability is a prime driver of variability in jellyfish abundance.
- Paul Spencer (USA) presented a poster that examined the rate of predation of arrowtooth flounder on walleye pollock in the Bering Sea in relation to different water temperatures.

Comparisons of model results with observations were given in three presentations.

1. Temperature and salinity fields in the Bering Sea were compared to outputs from a recent ROMS circulation model using a variety of statistical methods (Seth Danielson, USA)
2. Empirical Orthogonal Functions (EOFs) were used in comparisons of biophysical patterns derived from model output and from observations on the Bering Sea Shelf (Albert Hermann et al., USA).
3. Igor Belkin (USA) and colleagues compared results from a ROMS model for the North Atlantic and found good correspondence with observations.

Examples of new approaches and applications were presented by the following.

- Geir Huse (Norway) used super-individuals to model zooplankton in the Norwegian Sea

- Wolfgang Fennel (Germany) presented an Eulerian model for the Baltic Sea, extending from nutrients to fish.
- Shin-ichi Ito (Japan) and colleagues discussed uncertainty in the growth of Pacific saury off Japan under climate change and indicated that future temperature increases will reduce juvenile growth.
- Daniel Howell (Norway) suggested the impossibility of predicting future recruitment with any degree of certainty and highlighted the need for a robust management system that can cope with unpredictable changes in recruitment.
- Neil Banas (USA) suggested ensemble forecasting of complex ecosystems using size-based models.
- Benjamin Planque (Norway) showed that a minimalist model using first principles was able to reproduce several of the main features of the ecosystem dynamics in the Barents Sea.

Two end-to-end models were also presented.

- Kate Hedstrom (USA) described one such model that has been developed for the California Current that goes from physics to fish to fishers.”
- Kerim Aydin (USA) and co-authors described (via a poster) a multispecies bioenergetics module that is part of an end-to-end model for the eastern Bering Sea.

Another interesting poster by Kjersti Busch and Svein Sundby (Norway) hypothesized that the small size of pelagic eggs may be related to viscous forces.

Plans for 2011-2012

The WGEMER will continue to develop an end-to-end model in conjunction with PICES and ICES scientists. They will also guide the editorial process for those papers from the above mentioned OSM session submitted for publication in the Journal of Marine Systems. Since this is a special issue dedicated to Bernard Megrey, who was a former chair of this Working Group, modeling papers from some of Dr. Megrey’s former colleagues who were not able to attend the 2011 OSM will also be considered for inclusion in this special issue.

6.2 WG on Climate Effects at Upper Trophic Levels (WGCEUTL; formerly WG4)

Activities 2010-2011

The main focus of WGCEUTL during 2010-2011 was to prepare for the ESSAS 2011 OSM, where the group sponsored a half-day workshop preceding the OSM, as well as a half-day theme session on Gadoid-Crustacean Interactions. Workshop participants reviewed the Working Group’s progress to date, and discussed plans for the future. At last year’s meeting it was decided that suitable papers from the theme session might be published as a special volume in a peer reviewed journal. Editors of Marine Ecology Progress Series (MEPS) agreed to publish a set of papers in a special theme section, to be guest edited by Earl Dawe (Canada), Franz Mueter (USA), and Olafur Palsson (Iceland).

Other recent activities include the continued acquisition of datasets from all subarctic regions. These datasets consist of time series of ocean climate variables as well as fishery and survey data for gadoid fishes and crustaceans. With the acquisition of data from West Greenland in 2011, comprehensive datasets have now been obtained for all ecosystems. These datasets have been compiled in a spreadsheet by Laurinda Marcello, a MS student

working with Franz Mueter at the University of Alaska Fairbanks. She has expanded her literature review and bibliography, which has been distributed to WG members along with the databases.

Plans for 2011-2012

After three years, the WG is now wrapping up current activities, culminating with the session at the ESSAS OSM and the special theme section in Marine Ecology Progress Series (MEPS). It was agreed that the WG should continue under the present Terms of Reference (ToRs) until that work is completed. A total of 12 potential contributions plus a synthesis paper have been identified for the MEPS special theme section. The deadline for manuscript submissions was set as 1 November 2011.

The WG will continue to complete the papers for the MEPS special issue, and will continue studies of predator–prey interactions through comparisons of the different subarctic regions with a special emphasis on spatial dynamics. A workshop is planned at the next ESSAS annual science meeting to focus on spatial dynamics of shrimp, crab, cod, and other upper trophic level species. At that point a decision will be made on whether the WG will continue under revised ToRs with a new focus on spatial dynamics, in line with the overall theme on spatial dynamics and Arctic-subarctic interactions. Franz Mueter has agreed to take the lead in proposing and organizing the workshop and identifying and inviting key individuals from each region. Regional experts will be invited to the meeting to discuss spatial dynamics of commercial crustaceans and cod populations.

6.3 Impacts of Previous ESSAS Working Groups

Jim Overland commented on how the ESSAS meeting in Hakodate had a big impact on the future direction of International Panel on Climate Change (IPCC) analyses and reports. Results of ESSAS climate research that impacted IPCC findings include not all models are equal, the age of model democracy is dead and hence models should be evaluated individually, and results from models should not simply be averaged. Only the best models for a given region or purpose should be selected for producing forecasts and projections. Moreover, uncertainty in the model results should be acknowledged by presenting appropriate ranges around mean trends.

Jim also spoke of a “new arctic reality” that recognizes a duality with regard to climate change. While climate change is occurring, it will still be very cold and dark in the Arctic during the winters and this will have an effect on ecosystem and especially fish productivity. When examining the response of an ecosystem to climate forcing in Arctic/subarctic regions, upper trophic levels should be included. Methods using large spatial averaging may lead to wrong conclusions, e.g. biology may have a power response to climate change, so the average fish may die, but hotspots may allow them to survive. Attention should be paid to the extremes (tails of the distribution) rather than just the means.

7. Emerging Issues and Future Directions

7.1 ESSAS Relationship with ICES

Dr. Adi Kellermann (Head of the ICES Science Program) was a guest attending this SSC meeting. He invited ESSAS to join the ICES Science program as one of their "regional"

programs, similar to ICES programs for the Baltic Sea, North Sea, western European shelf seas, and the NW Atlantic Ocean. ICES is interested in many of the same issues as ESSAS including climate change, climate impacts on the marine ecosystems, fisheries, etc.

Advantages: Potential benefits to ESSAS with the proposed arrangement with ICES included: financial and technical support for meetings, support for journal publications (which we have received from ICES in any case), and potential support for travel to meetings. Travel to ESSAS meetings is usually funded at the national level; however ICES does have some funds available to support such travel. (Currently, ESSAS gets some unrestricted support from IMBER; we also receive specific support for travel, technical support, etc., from ICES, PICES, and other organizations on occasion). ICES provided support of 10K Euros for the OSM and the ESSAS special issue of the ICES Journal of Marine Science.

Disadvantages: The proposed arrangement with ICES would require that ESSAS annually submit to ICES an expert group report, and that ESSAS be represented at ICES annual meetings. Most significantly it would mean that ESSAS would lose some of its independence and its status as an international program that spans relevant regions for both ICES and PICES. There would be little advantage for our Asian scientists to be connected to ICES. Affiliation with ICES would create an asymmetry in our relationships with ICES and PICES.

The ICES proposal generated much debate, both pro and con. In the end, however, the SSC decided to remain an independent organization under IMBER and not to become officially affiliated with ICES. However, ESSAS will continue to contribute to ICES, as in the past.

ACTION: Ken and Franz will write a letter to Adi Kellermann explaining the ESSAS SSC decision and the reasons why, as well as clarifying terms of future collaboration and information sharing with ICES.

7.2 Future Directions

There was a lot of discussion on the future directions that ESSAS should take. While this included discussions on the WGMER and WGCEUTL reported above, much of the time was spent discussing possible new issues for ESSAS, most notably the following two issues.

Arctic–Subarctic Interactions

During the last number of years, ESSAS has begun to work in the Arctic and on the interactions with the Subarctic through exchange processes. Examples include the IPY work undertaken by the Japanese, Chinese, Americans, Canadians and Norwegians as part of ESSAR (Ecosystem Studies of Subarctic and Arctic Regions), the ESSAS lead IPY coalition; the recent comparative study between the Chukchi and Barents Seas being lead by George Hunt; the research being carried out by Koreans; and the joint activities of ESSAS and ASOF (Arctic-Subarctic Ocean Fluxes). In addition, a workshop on Arctic-Subarctic Interactions was held as part of the OSM. Jim Overland noted that working on Arctic issues would be topical, especially examining what will happen under climate change given the ongoing reduction in sea ice. Also, IMBER had enquired at an earlier SSC meeting of theirs whether ESSAS would be willing to work on Arctic issues since this was an area where IMBER did not have any regional program. While extending major effort in the Arctic may be

unrealistic at this time, the interaction between the Arctic and Subarctic is important in understanding the changes in both regions.

After the discussion, it was decided that a new ESSAS Working Group on Arctic–Subarctic Interactions (WGASI) would be formed. This WG will seek to promote research on this important topic and will begin by holding theme sessions and workshops over the next 1 to 2 years on the role of the advection and water exchanges in structuring the biology of Arctic-Subarctic transition zones. A proposal for a theme session on Arctic–Subarctic interactions to the Ocean Sciences meeting for consideration at their February 2012 meeting in Salt Lake City, USA that would be co-sponsored by ESSAS and ASOF as part of their ongoing cooperation had already been suggested during the OSM Workshop. Additional theme sessions or workshops in 2012 were suggested by the SSC including as part of the Climate Change meeting in Yeosu, Korea to be held in May, at the ICES Annual Science Conference to be held in Bergen in September and the PICES Annual Meeting are being considered. Ken Drinkwater and Jim Overland agreed to co-lead the WG.

ACTION: Ken Drinkwater and Jim Overland to develop ToRs for WGASI.

ACTION: Ken Drinkwater and Jim Overland to submit proposals on Arctic-Subarctic Interaction sessions for 2012 meetings at Yeosu, ICES ASC in Bergen and PICES Annual Meeting in Hiroshima.

Human Dimensions / Social Economics

The possibility of forming a Working Group on Human Dimensions (WGHD) was discussed. Keith Criddle (USA) informed the SSC that the Human Dimensions Theme Session at the OSM was rewarding with good presentations on several socio-economic issues. During the discussions following the presentations, the idea of an ESSAS WGHD was brought up by the presenters but Keith felt it might be premature to form a WGHD at this stage. It was suggested that comparative studies on HD between the ESSAS areas might be a fruitful topic. No firm commitment to form a WGHD was made but it was suggested to encourage some of those attending the OSM theme session on Human Dimensions to attend our next ESSAS ASM to present some of their work and to discuss the possibility of forming an ESSAS WGHD. The topic of a WGHD will be revisited at the next SSC meeting.

7.3 Future ESSAS Theme Sessions and Workshops

Other future ESSAS workshops and theme sessions in the coming year were also discussed, which included:

- An ESSAS Workshop or Session at ICES on Zooplankton, although this will depend on what is submitted by the ICES WG on Zooplankton Ecology.

ACTION: Erica will look into submitting a proposal to the ICES 2012 ASC for an ESSAS workshop or session on zooplankton with co-chairs potentially being Erica Head (Canada), and Torkel Nielsen (Denmark), and a researcher from Asia.

- Proposals of Theme Sessions on spatial dynamics in Subarctic Seas should be considered for both ICES 2012 (Bergen) and PICES 2012 (Hiroshima).

8. Website Development

Margaret McBride led a discussion of recent changes/additions, current status, and suggestions to improve the ESSAS website. A number of issues were raised.

- There is still very slow response by SSC members to submitting their agreed upon reports for the featured articles on the website. Margaret encouraged them to submit their articles on time.
- It was suggested that the presentations from the previous year's ASM should be on the web, after checking that the presenters agree to post them. They should be put into pdf format to go on the web.
- There should be a link to the PICES website displaying the OSM abstracts and presentations.
- The list of primary publications should be from newest to oldest, the reverse of the way it presently is listed.
- The question was raised as to whether the number of hits on the ESSAS website can be recorded. This might be difficult because the ESSAS website is part of the IMR websites.

ACTION: Margaret to make presentations from previous year's meetings available in pdf format, make links to PICES website regarding OSM materials, reverse the order of the primary publication list and enquire as to possibility of recording number of hits.

9. ESSAS Ongoing Issues

9.1 Budget

The budget for this year and the coming year is still unclear.

- We don't yet know the financial outcome of the OSM, but expect to at least break-even.
- George expects that ESSAS should have on the order of \$20-\$25,000 for next year. This includes the possibility of \$5,000-\$10,000 from IMBER for 2011 that could not be used, plus an additional \$15,000 for next year. This is a more than normal set of resources that could be used to bring in 2-3 people per workshop, assuming 3 workshops.
- PICES has in the past picked up the cost for someone from PICES to attend our ASMs.
- There is the possibility of some support from Japan (\$15,000) to bring a few speakers to Japan for the next ESSAS ASM

ACTION: Ken to request the usual ESSAS funding from IMBER (\$15,000) for 2012 and enquire if ESSAS can carry over this year's funds to next year.

ACTION: Sakurai-san to seek funding to bring a few speakers to Japan for next ASM.

ACTION: Ken and Franz to clarify budget.

9.2 IMBER

Financial support for the IMBER office in France is no longer available. A proposal has been submitted by Ken Drinkwater on behalf of IMBER to Norwegian Research Council to move the IMBER International Project Office to Bergen, Norway. Notification of whether the proposal will be successful should be in the fall.

IMBER has a newly formed Human Dimensions working group that wishes to be informed about any work on this front by regional programs within IMBER.

ACTION: Ken will inform Alida Bundy to inform her about what ESSAS is doing in regards to human dimensions work.

ACTION: Franz will contact presenters in the Human Dimensions session to thank them for stimulating discussion at the OSM

9.3 SSC Membership

Dr. Franz Mueter

As mentioned at the beginning of the report Dr. Franz J. Mueter has been appointed as the new ESSAS Co-Chair. Dr. Mueter is a faculty member at the Juneau Center of the University of Alaska where he teaches quantitative fisheries courses, supervises a number of graduate students, and conducts research on the effects of environmental variability on the distribution, growth, and survival of fishes in subarctic and Arctic waters. His research initially focused on the early life history of pollock and flatfishes in nearshore waters of the Gulf of Alaska, and gradually expanded to include adult groundfish communities throughout the Gulf of Alaska and Bering Sea. He has also modeled recruitment processes of salmon in relation to temperature variability throughout the Northeast Pacific and has worked on other anadromous species in Alaskan waters, including the Beaufort Sea. He has been active within ESSAS as Co-Chair of the Working Group on Climate Effects at Upper Trophic Levels. Also, he has played a significant role in ESSAS comparative studies between Norway and Canada (MENU), and the follow-up project on stock production modeling that also included Canada (CAMEO/CANUSE/MENUII). He is particularly interested in the applied aspects of his research as they relate to the management of fisheries resources in the face of global climate changes. He is currently involved in two multi-disciplinary integrated ecosystem research programs: in the Bering Sea (BEST - BSIERP); in the Gulf of Alaska Integrated Ecosystem Research Program (GOA IERP); and in the northern Bering Sea and Chukchi Sea where he leads the Arctic Ecosystem Integrated Survey (Arctic Eis).

Dr. George L. Hunt, Jr.

Dr. Hunt stepped down as ESSAS co-chair but will remain on the ESSAS SSC as an ex-officio member.

Dr. Sen Tok Kim

Dr. Kim has been appointed a new SSC member representing Russia. Dr. Kim is a marine biologist heading the laboratory of commercial fishes at the Sakhalin Scientific Research Institute of Fishery and Oceanography (SakhNIRO) in Yuzhno-Sakhalinsk, Russia. He received his undergraduate degree in 1983 from the Far-Eastern State University in Vladivostok and his PhD in 1997 from the Institute of Marine Biology in Vladivostok where he studied the biology of Pacific cod off Sakhalin and Kuril islands. His current research interests include biological aspects and dynamics of fishery resources and spatial-temporal changes of fish community structure on the continental shelf and upper slope zone in areas of the East Sea and Sea of Okhotsk.

Dr. Sung-Ho Kang

Dr. Kang was appointed to the ESSAS SSC to represent Korea. He is a Principal Research Scientist at the Korea Polar Research Institute's (KOPRI) Division of Polar Climate Research. His research interests include studies of polar marine ecology focused on primary productivity. At KOPRI, he has directed both the Division of Polar Biology and Ocean Sciences, and the Division of Applied Polar Sciences. He has served as Vice Chair of the

Arctic Ocean Science Board. Recently, he has been leader of the King Sejong Korea Antarctic Research Station located in Barton Peninsula, King George Island.

Dr. Hyung-Cheol Shin

Dr. Shin who previously represented Korea stepped down due to changing commitments at KOPRI where he works. ESSAS appreciates Dr. Shin's involvement in the organization and wishes him well in his future activities.

Other Potential SSC Members

There was discussion on the possibility of adding extra SSC members, especially from Greenland, Germany and China. For Greenland, Thomas Juul-Pedersen's name was mentioned as he has attended a couple of ESSAS meetings. Our understanding that he was asked by Soren to represent Greenland. For Germany, Dr. Michael Klages' name was suggested as he is the lead person in the Fram Strait work that the Alfred Wagner Institute has been conducting. No name sprang to mind from China.

ACTION: Ken will contact Jinping Zhao to ask him for recommendations of potential SSC members from China.

ACTION: Ken will contact Michael Klages and Thomas Juul-Pedersen to ask if they are interested in becoming SSC members.

Addition of third Co-Chair

The possibility of having three ESSAS co-Chairs was also discussed. It was decided that Yasunori Sakurai would be invited to serve as co-Chair, and that a second Japanese researcher from the Fisheries Research Agency would be asked to join the SSC.

ACTION: Ken will ask Yasunori Sakurai to become the 3rd ESSA co-Chair, and to recommend a person from Japan's FRA to be on the SSC.

ACTION: Ken is to contact those nominated as potential new SSC members.

10. National Programs

10.1 Canada

Canada has no national ESSAS programme, although Canadian scientists have been involved in the international programme NORCAN, and in WGCEUTL, reports of which are given elsewhere. As well, Canadian scientists carry out a series of activities on a routine basis that contribute to ESSAS goals. These include:

Monitoring of the ecosystem in the Northwest Atlantic by scientists from the Department of Fisheries and Oceans – the Atlantic Zone Monitoring Programme (AZMP) and the Atlantic Zone Offshore Monitoring Programme (AZOMP)

Outlines of the programmes and examples of the products can be found at <http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-qdsi/azmp-pmza/index-eng.html> and <http://www.bio.gc.ca/monitoring-monitorage/azomp-pmzao/index-eng.htm>, respectively.

The AZMP includes running sections on the Scotian, Newfoundland and Labrador shelves and in the Gulf of St Lawrence 1-3 times per year to measure hydrographic, chemical and biological (lower trophic levels) variables. The same measurements are made at monthly

intervals at a series of fixed stations including locations off Halifax (Stn HL2, Scotian Shelf), St John's (Stn 27, Newfoundland Shelf) and in the Bay of Fundy and St Lawrence Estuary. In addition, survey cruises to assess macrofauna (fish and invertebrates) biomass are also routinely made 1-2 times per year. The AZOMP involves running a section across the Labrador Sea once per year and sampling in the deep western boundary current beyond the Scotian Shelf.

Other AZMP activities include (1) providing financial support to the Sir Alister Hardy Foundation for Ocean Science (SAHFOS) for the collection and analysis of samples by means of the continuous plankton recorder (CPR) in the Northwest Atlantic (and the analysis/interpretation of data by DFO researchers), and (2) processing remotely-sensed satellite data on ocean colour and sea-surface temperature. Images are available at http://www2.mar.dfo-mpo.gc.ca/science/ocean/ias/seawifs/seawifs_1.html.

The AZMP and AZOMP routinely report on conditions for the previous year at annual meetings held in late March. Research Documents, containing summaries of the results for the preceding year, are peer-reviewed internally and published on the DFO website (<http://www.isdm-gdsi.gc.ca/csas-sccs/applications/publications/index-eng.asp#RES>). AZMP Bulletins containing articles based on the programmes are also published annually (<http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/publications-eng.html>) and individual scientists use AZMP data to write articles that are submitted to scientific journals.

Other ESSAS-relevant Research Initiatives

The "Science Plan and Implementation Strategy" for the BASIN (**B**asin-scale **A**nalysis, **S**ynthesis, and **I**ntegration) programme was published in 2009 and is available on the IMBER (**I**ntegrated **M**arine **B**iogeochemistry and **E**cosystem **R**esearch) website http://www.imber.info/products/BASIN_article.pdf. Its goal is to understand and predict the impact of climate change on key species of plankton and fish, and associated ecosystems and biogeochemical dynamics in the North Atlantic Sub-polar Gyre System and surrounding shelves, in order to improve ocean management and conservation. Thus, it shares some of the objectives of the ESSAS programme.

The EU is providing funding for a EURO-BASIN programme, although each participating nation must provide matching funds for its participants, and negotiations are ongoing for this part of the process. Its work-packages and brief project descriptions can be found at <http://www.us-ocb.org/archives/EUROBASINJAN51542.pdf>. Canada expects to be involved with one or more of the projects, e.g. by providing a platform for European scientists to work in the NW Atlantic during AZMP and AZOMP cruises. In the US, the National Science Foundation will accept proposals for BASIN projects via the normal panels. Canada's participation in EU and US projects will involve a minimal outlay of funds, but a significant input in terms of in-kind contribution (e.g. sampling platforms, data, expertise, etc.).

10.2 Iceland

The main national Icelandic contribution to ESSAS program is through The Ecology of the Iceland Sea (ISE) Project which had field activity in 2006-2008. Currently the main work involves analysis of ISE data and preparation for publication, while further field activity has not been decided upon at this stage. However, routine field activity and mainly related to

acoustic assessment of the capelin stock in the Iceland Sea is being continued and is generating important data for comparison with the intense field activity in 2006-2008.

The project's main objective is to further understanding of the Iceland Sea, particularly the capelin stock for which the Iceland Sea is the main feeding area. Investigations conducted include: 1) hydrography (temperature, salinity, currents, watermasses); 2) nutrients; 3) phyto- and zooplankton; and 4) energy transfer through the ecosystem and how these factors affect the life history and distribution of capelin. A considerable modeling effort, mainly with respect to migration of capelin, is underway relative to the project.

Iceland is also contributing to the work of WGCEUTL, where the emphasis has been on the interactions between cod and deepwater shrimp (e.g. fisheries, stock size, recruitment) in Icelandic waters and also participation in circumpolar comparisons on the effect of environmental and predation related factors on recruitment.

The ESSAS ASM 2010 was held at the Grand Hotel Reykjavik, Iceland in August 30 -1 September, followed by an SSC meeting 2-3 September at the Marine Research Institute, which also hosted the ASM. At the Reykjavik meeting, one day was specially dedicated to the Iceland Sea Ecology Project (see list of presentations below). Further results from most of the subprojects were presented at the OSM and manuscripts are being prepared for peer-reviewed publication in one of the several special volumes resulting from the OSM.

Data Analysis

In earlier years, to the extent possible, data analysis for different sub-projects has been conducted while doing field work, but during the past two year, as stated above, the main work now focuses on data analysis and synthesis of results for publication. Some details on the current status on the analysis for different Iceland Sea subprojects is given below.

Hydrography and Nutrients

All data have been processed and are available for further analysis.

Phytoplankton

All biomass and production measurements from 2006-2008 have been worked up. During 2010 the emphasis has been identification and enumeration of species for community analyses (south-north, east-west species composition along transects). This work, which is expected to finish during 2011 is targeting key stations/areas based on measurements of biomass and production.

Zooplankton

Some zooplankton samples were frozen for biomass analysis; others were fixed for systematic and life history studies. All frozen samples have been weighed and the analysis of the fixed samples is expected to be completed in 2011.

Food Chain Studies

Selected ecological groups (phytoplankton, zooplankton, fish) were sampled in 2008. Measurements of isotopes of carbon and nitrogen, fat content and fatty acid, and alcohol composition have now been completed at Unilab in Tromsø, Norway.

Fish Studies/Capelin

Fish samples collected during 2006-2008 have been processed and are now being analysed.

Modeling Capelin Migration

In the autumn of 2007 professor Bjorn Birnir from the University of Santa Barbara in California and professor Svend Sigurdsson from the University of Iceland teamed up with the Ecosystem of the Iceland Sea Project and since then, 2 of their doctoral students have been undertaking modeling work with the aim of simulating the spawning migration of capelin. One of these studies, by Baldvin Einarsson, is in its final stages and is expected to be completed soon. It examines interacting particle models with applications to capelin migrations. Investigations have been carried out on the behavior of the particle model and how its parameters scale with the number of particles. A Dynamic Energy Budget (DEB) model for capelin will be developed to estimate the roe content of individual fish.

Presentations at the ESSAS ASM held in Reykjavik 30 August -1 September 2010.

- Valdimarsson, H. and Jonsson, S. The hydrographic conditions in the Iceland Sea and the role of Kolbeinsey ridge.
- Olafsdóttir, S. and Gudfinnson, H. Variations on the concentrations and uptake of nutrients in the Iceland Sea.
- Gislason, A. Seasonal changes in the zooplankton communities of the Iceland Sea during spring and summer.
- Peturdóttir, H. Trophic relations of zooplankton in the Iceland Sea.
- Thorisson, K., Gunnarsson, B. Drift and origin of capelin larvae.
- Pálsson, O.K., Sveinbjörnsson, S., Valdimarsson, H., Gislason, A. The ecology of capelin in the Iceland Sea.
- Barbaro, A., Einarsson, B., Birnir, B., Sigurðsson, S.P. Integrating dynamic energy budget model into a capelin migration mode.

In relation to WG 4 the following presentation was given at the Reykjavik meeting.

- Ingibjörg Jonsdóttir. Interaction between northern shrimp and cod in Ísafjarðardjúp, northwest Iceland.

At the IPY meeting in Oslo 8-12 June 2010 the following presentation and poster were presented.

- Gislason, A. Abundance, composition and development of zooplankton in the subarctic Iceland Sea during summer in three years (2006-2009).
- Petursdóttir, H., Gislason, A. Trophic interactions and energy flow within the pelagic ecosystem of the Iceland Sea (POSTER).

Publications

Gislason, A., Silva, T. 2009. Comparison between automated analysis of zooplankton using Zoolmage and traditional methodology. *Journal of Plankton Research* 31:1505-1516.

10.3 Japan

The Japanese ESSAS (J-ESSAS) program works to quantify the impact of climate variability on the structure and function of the Okhotsk Sea and Oyashio marine ecosystems, to predict the response of these ecosystems to future climate change, and to predict the associated potential economic impact. The program's action plan is to:

- Systematically investigate the major mechanisms by which climate change might be expected to affect the Okhotsk Sea and Oyashio Region;
- Investigate which of the IPCC Climate models best predicted regional climate patterns and to provide the most useful future climate scenarios; and
- Use modeling approaches
 - To compare present-day Okhotsk Sea and Oyashio marine ecosystems
 - To predict how climate change might be expected to affect these ecosystems and their ability to sustain fisheries and other human activities.

Ongoing funded J-ESSAS research activities

- The Japanese-GLOBEC (Global Ocean Ecosystem Dynamics) project (2005-2009 plus) focused on ecosystem-based management & sustainable fisheries;
- The Shiretoko World Natural Heritage Environment Agency project (2005-2015) focuses on “Balancing conservation of the marine ecosystem with sustainable fisheries in Shiretoko, Japan, a World Natural Heritage Site”.
- The DoCoFis project FRA, Fisheries Agency (2004-2010 & 2011-2015) focuses on recruitment variability of Japan Pacific walleye pollock. This project comprised studies on physical oceanography, satellite imaging, egg and larval distribution/abundance, juvenile ecology and modeling.
- The Management Challenges for Future Fisheries (Knowledge Cluster Project by MEXT (2009-2014) focuses on “development of spatial modeling for scallop and kelp using satellite remote sensing and marine-GIS”, “development of integrated coastal fisheries information system with 4-D VAR data assimilation model”, “short-term prediction: disaster protection for aquaculture sites”, and “middle and long-term prediction: production control and management” in water of southern Hokkaido, Japan.

New J-ESSAS Research Projects

- Assessment of potential biogeochemical impacts from rapid sea ice reduction in the Arctic Ocean (2011-2015) funded by Japan Education and Technology Agency;
- Construction of a new research vessel of “Oshoro-maru”, Hokkaido University (Proposed to JETA for 2012-2014/or 2015).

10.4 Korea

On behalf of Sung-Ho Kang, Ken Drinkwater presented a report on “Korea Arctic Ocean Studies”, the overarching goal of which is to monitor the marine ecosystem as it responds to ongoing environmental changes in the western Arctic Ocean. Toward that end, an oceanographic survey was conducted from Nome to Nome, July 17 - August 12, 2010 — to examine physical and biological oceanographic conditions in the Chukchi Sea. During this survey, the topics of investigation included:

- Hydrography and water mass
- Biogeochemical cycles of bio-gas
- Microbial diversity and community structure
- Diversity and biogeography of diatoms
- Phytoplankton ecology and physiology
- Protozoan community structure and grazing rate
- Trophic role of zooplankton

- Glacial history and paleo-oceanographic changes

Specific cruise objectives were to carry out studies and collect data to:

- Find the correlation between water intrusion and sea ice distribution
- Determine the temperature – salinity structure
- Find the origin of warm water from the Pacific
- Study current velocity fields and eddy structure
- Determine the uptake rates of carbon and Nitrogen in phytoplankton
- Understand controlling factors for phytoplankton carbon/nitrogen production
- Identify the effect of light enrichment on carbon/nitrogen production rates in the chlorophyll-a maximum layers
- Improve understanding of specific feeding interactions and pathways of carbon flow by protozoa
- Study protozoan abundance, diversity and community structure
- Compare the roles of protozoan and copepod as herbivores

Tentative plans for later in 2011 were to conduct a similar survey of the Chukchi Sea (onboard R/V ARAON) to study mass flux by monitoring the temporal and vertical variability of suspended materials.

10.5 Norway (Ken Drinkwater)

NESSAR is the Norwegian IPY project which focused on the physics and biology of the fronts between the warm, salty Atlantic waters and the colder, fresher Arctic or Polar waters. The first 3 years included several cruises to the Norwegian Sea and the Barents Sea. In 2009 the final cruise was carried out in the Barents Sea in the autumn by the Norwegian Polar Institute under the direction of Dr. Vladimir Pavlov of the Norwegian Polar Institute. During the past year, we have undertaken more analysis of the data and began to write up several papers on the results. A special issue of the Journal of Marine Systems was secured, which could receive upwards of 12-15 papers covering various aspects of physics, bacteria, phytoplankton, zooplankton and fish and their interactions. It is also planned to present the results from NESSAR at the next IPY Conference, which will occur in Montreal during the spring of 2012.

BarEcoRe (Barents Sea Ecosystem Resilience) is a Norwegian project that was endorsed by ESSAS in June of 2010. Its objective is to evaluate the effects of global environmental change on the future structure and resilience of the Barents Sea ecosystem through investigating the effects of past changes in climate and fisheries on the Barents Sea ecosystem, by developing indicators of ecosystem resilience, diversity and structure, and by forecasting the possible future states of the Barents Sea ecosystem under particular 17 environmental and fisheries scenarios. The Kick-off Meeting was held in June 2010 and the second meeting is planned for October of this year.

10.6 U.S.A. (Mike Sigler)

ESSAS activities in the US included continuation of the Bering Ecosystem Study Program and Bering Sea Integrated Ecosystem Research Program (BEST/BSIERP) in the Bering

Sea. The BEST/BSIERP program in the eastern Bering Sea has finished fieldwork. Approximately 25,000 person-days were completed in the field. During the field years of 2007-2010, the Bering Sea was cold and production of large zooplankton and gadoid fishes increased compared to warm years during 2001-2005. The years 2011-2013 will be devoted to analyses and synthesis of the findings. Funding is in place for the BSIERP portion of the program, and additional funds are being competed by NSF to support analyses and synthesis in the BEST portion of the integrated program.

A Bering Sea session was held during the 2011 ESSAS Open Science Meeting during 22-26 May in Seattle, Washington. About 20 talks during this session and other OSM sessions were based on the BEST/BSIERP program.

Publications

Mueter F.J., Siddon E.C., and Hunt G.L. Jr. 2011. Climate change brings uncertain future for subarctic marine ecosystems and fisheries (Book chapter) University of Alaska Press, Fairbanks

Danielson S, Curchitser E, Hedstrom K, Weingartner T, and Stabeno P. 2011. On ocean and sea ice modes of variability in the Bering Sea. *Journal of Geophysical Research* (in press)

Benoit-Bird KJ, Kuletz K, Heppell S, Jones N, and Hoover B. 2011. Active acoustic examination of the diving behavior of murrelets foraging on patchy prey *Marine Ecology Progress Series* (in press)

Dorresteijn I, Kitaysky AS, Barger C, Benowitz-Fredericks ZM, Byrd GV, Shultz M, and Young R. 2011. Climate variability affects food availability to planktivorous least auklets, *Aethia pusilla*, through physical processes in the southeastern Bering Sea *Marine Ecology Progress Series* (in press)

Granger J, Prokopenko MG, Sigman DM, Mordy CW, Morse ZM, Morales LV, Sambrotto RN, and Plessen B. 2011. Coupled nitrification-denitrification in sediment of the eastern Bering Sea shelf leads to 15N enrichment of fixed N in shelf waters *Journal of Geophysical Research* (in press)

Sigler MF, Renner M, Danielson SL, Eisner LB, Lauth RR, Kuletz KJ, Logerwell EA, and Hunt GL Jr. 2011. Fluxes, Fins, and Feathers: Relationships Among the Bering, Chukchi, and Beaufort Seas in a Time of Climate Change. *Oceanography*.

Fienup-Riordan A. 2012. Water: The Gift of a Good Question *Arctic Anthropology* (in press)

Gibson GA and Spitz YH. 2011. Impacts of biological parameterisation, initial conditions, and environmental forcing on parameter sensitivity and uncertainty in a marine ecosystem model for the Bering Sea. *Journal of Marine Systems*.

Stabeno PJ, Napp JM, Mordy C, and Whitedge T. 2010. Factors influencing physical structure and lower trophic levels of the eastern Bering Sea shelf in 2005: Sea ice, tides and winds. *Progress in Oceanography*.

- Stafford KM, Moore SE, Stabeno PJ, Holliday DV, Napp JM, and Mellinger DK. 2010. Biophysical ocean observation in the southeastern Bering Sea Geophysical Research Letters 20 Fienup-Riordan A and Carmack E 2011 The Ocean is Always Changing: Nearshore and Farshore Perspectives on Arctic Coastal Seas. Journal of Oceanography.
- Mueter FJ, Bond NA, Ianelli JN, and Hollowed AB. 2011. Expected declines in recruitment of walleye pollock (*Theragra chalcogramma*) in the eastern Bering Sea under future climate change. ICES Journal of Marine Science.
- Siddon EC, Duffy-Anderson JT, and Mueter FJ. 2011. Community-level response of fish larvae to environmental variability in the southeastern Bering Sea. Marine Ecology Progress Series.
- Rearden A and Fienup-Riordan A. 2010. "The Ice is Always Changing": Yup'ik Understandings of Sea Ice, Past and Present SIKU: Knowing Our Ice 16 Fienup-Riordan A 2010 Yup'ik Perspectives on Climate Change: "The World is Following Its People" (prefinal) The Inuit and Climate Change.
- Fienup-Riordan A and Rearden A. 2010. Ellavut/Our Yup'ik World and Weather University of Washington Press (in press)
- Rearden A and Fienup-Riordan A. 2010. Stories are All Around Us: Qaluyaarmiut Places and Their Meanings University of Washington Press (in press)
- Satterthwaite, WH, Kitaysky AS, Hatch SA, Piatt JF, and Mangel M. 2010. Unifying quantitative life-history theory and field endocrinology to assess prudent parenthood in long-lived seabird. Evolutionary Ecology Research.
- Zhang J, Woodgate R, and Moritz R. 2010. Sea ice response to atmospheric and oceanic forcing in the Bering Sea. Journal of Physical Oceanography.
- Hunt GL, Coyle KO, Eisner LB, Farley EV, Heintz R, Mueter FJ, Napp JM, Overland JE, Ressler PH, Salo S, and Stabeno PJ. 2011. Climate impacts on eastern Bering Sea food webs: A synthesis of new data and an assessment of the Oscillating Control Hypothesis. ICES Journal of Marine Science.
- Coyle KO, Eisner LB, Mueter FJ, Pinchuk AI, Janout MA, Farley EV, Ciciel K, and Andrews AG. 2010. Climate change in the southeastern Bering Sea: impacts on pollock stocks and implications for the Oscillating Control Hypothesis. Fisheries Oceanography.
- Aguilar-Islas AM, Rember R, Mordy C, and Wu J. 2008. Sea ice-derived dissolved iron and its potential influence on the spring algal bloom in the Bering Sea. Geophysical Research Letters.
- Smith JN, Ressler PH, and Warren JD. 2010. Material properties of euphausiids and other zooplankton from the Bering Sea. Journal of the Acoustical Society of America.

Danielson S, Eisner L, Weingartner T, and Aagaard K. 2010. Thermal and haline variability over the central Bering Sea shelf: Seasonal and interannual perspectives. *Continental Shelf Research*.

Mathis JT, Cross JN, Bates NR, Moran B, Lomas MW, Mordy CW, and Stabeno PJ. 2010. Seasonal distribution of dissolved inorganic carbon and net community production on the Bering Sea shelf. *Biogeosciences Discussions*.

Bacheler NM, Ciannelli L, Bailey KM, and Duffy-Anderson JT. 2010. Spatial and temporal patterns of walleye pollock spawning in the eastern Bering Sea inferred from egg and larval distributions. *Fisheries Oceanography*.

Bacheler N, Bailey KM, Ciannelli L, Bartolino V, and Chan KS. 2009. Density-dependent, landscape, and climate effects on spawning distribution of walleye pollock *Theragra chalcogramma* Marine Ecology Progress Series.

Hollowed AB, Bond NA, Wilderbuer TK, Stockhausen WT, A'mar TZ, Beamish RJ, Overland JE, and Schirripa MJ. 2009. A framework for modelling fish and shellfish responses to future climate change *ICES Journal of Marine Science*.

Hunt GL, Stabeno PJ, Strom S, and Napp JM. 2008. Patterns of spatial and temporal variation in the marine ecosystem of the southeastern Bering Sea, with special reference to the Pribilof Domain. *Deep-Sea Research II*.

10.7 West Greenland

Greenland does still not have any projects which are officially endorsed by ESSAS. Ecosystem studies are being conducted in Greenland fjord systems as well as in coastal and offshore waters by the Greenland Centre for Climate Research (GCCR), the Greenland Institute of Natural Resources (GINR) and its partners, in particular the National Institute of Aquatic Resources at the Technical University of Denmark (DTU Aqua). Results from some of these studies were presented by researchers from DTU Aqua at the ESSAS ASM in Reykjavik 2010 and by researchers from GCCR, GINR and DTU Aqua at the ESSAS OSM in Seattle 2011. Further attempts to engage researcher working in these studies into ESSAS activities will continue by sending information on future ESSAS workshops and annual science meetings to GCCR and GINR in Greenland as well to their partners at DTU Aqua in Denmark. The possibility of convening an ESSAS ASM in Copenhagen, Denmark or Greenland was discussed. Such a meeting could expand their interest in ESSAS and gain some momentum within the group of scientists there.

ACTION: Kai will speak with his Greenland colleagues about the possibility of hosting the ESSAS ASM in Copenhagen, either in the fall of 2013 or winter of 2014.

11. Multi-national Programs

11.1 ESSAR – IPY Consortium

ESSAS organized and led the IPY consortium Ecosystem Studies of Subarctic and Arctic Regions (ESSAR) that consisted of 11 projects and 9 countries. A theme session entitled “New insights from the International Polar Year (IPY) studies” was held at the OSM to present results from these and other IPY studies. In total, 23 presentations were made, three of which were invited oral talks, another 9 were oral presentations in the contributed afternoon parallel session, and 11 were posters. Invited speakers/topics included:

- Eddy Carmack (Canada) spoke on Canada’s 3 Oceans (C3O) project that collected data from Vancouver in the Pacific to Halifax in the Atlantic and traversed the Canadian Archipelago.
- Tony Gaston (Canada) presented results from seabird studies in Canada’s high Arctic.
- Naomi Harada (Japan) focused upon blooms of the coccolithophore *Emiliana huxleyi* in the Bering Sea

Contributed presentations covered all aspects of the ecosystem from physics to seabirds and geographically from the Arctic to most of the subarctic seas. Two oral presentations and five posters provided results from the Iceland Sea Ecosystem (ISE) project. Three posters presented results on capelin, the principal focus of the ISE Project. The final poster presented distributional changes in the capelin. Two papers were presented from the Norwegian ESSAR project. Three seabird presentations were made. One poster presented the Integrating Climate and Ecosystem Dynamics in the Southern Ocean (ICED) project that aims towards a circumpolar analyses of Southern Ocean climate and ecosystem dynamics. While a synthesis of the many and varied studies undertaken during IPY is not possible at this stage, it is clear that much has been learned but that we still have far to go to understand these ecosystems.

11.2 USA/Norway/Canada (MENU, MENUII, CAMEO, CANUSE)

The second trilateral workshop on stock production modeling was held on May 2-6, 2011, in Woods Hole, MA that included 23 participants from Canada, Norway, and the U.S. was organized by Jason Link (USA). Observers from Denmark and Italy also attended. The theme of the workshop was to continue analyses begun at the first workshop in 2010 that centered around production models for comparisons at different hierarchical levels (e.g., species, guild, ecosystem) for many of the major northern hemisphere large marine ecosystems that have supported notable fisheries. The workshop objectives were to compare ecosystems of Canada, Norway and the US (many of the systems are ESSAS regions); continue, refine and organize analyses and outputs; and identify similarities and differences between ecosystems and the relative effects of physical forcing, trophodynamics, and fisheries exploitation drivers on fish production. The workshop several presentation abstracts for the ICES 2011 ASC Theme Session on Stock Production Models, proposals for other theme sessions or symposia, a special journal volume proposal, 10 updated analytical tools, database querying tools, and additions to an already comprehensive database. Analyses enabling comparison across systems, species, drivers, covariates, and modeling approaches were completed during the workshop. These results focused on comparable total system biomass production, functionally equivalent species biomass production, or simulations of aggregation. Preliminary results suggest that there are some common patterns driving overall fisheries production in these northern hemisphere ecosystems, but that the prominence of any particular driver varies among these systems. Some fundamental features of marine ecosystems were likely established, which will be reported on in the forthcoming primary literature.

The MENUUI project, which was funded by the Norwegian Research Council, besides contributing to the Stock Production Workshop, has been comparing ecosystems across the North Atlantic through modeling of larval cod responses to temperature variability. A paper on the results that included both Norwegian and American co-authors was recently published (Kristiansen et al., 2011, PLoS One). In addition, development of the ATLANTIS model for the Barents and Norwegian Seas has continued as part of MENUUI with the modeling being undertaken by Cecilie Hansen, a post-doc. The work is progressing well but given the complexity of the model, results are not expected until at least the end of year or early next year. This is consistent with the development times of already existing ATLANTIS models. Cecilie has been discussing the model with Jason Link, who led a US team that built an ATLANTIS model for Georges Bank and the Gulf of Maine.

11.3 Canada/Norway (NORCAN)

NORCAN (Norway-Canada Comparative Studies of Marine Ecosystems) has been comparing several components of the Norwegian/Barents Seas and Labrador Sea and Newfoundland/Labrador shelf ecosystems. Papers with co-authors from both countries are in various stages of preparation and review covering physical oceanography, phytoplankton, zooplankton, cod and 3 on capelin. An introduction to the study will also be written. The results from the NORCAN series of studies will appear in special volume of Progress in Oceanography.

11.4 Norway/US/Canada/Russia (Trophic Interactions in the Arctic-TrophArct)

TrophArct is an ESSAS endorsed project that consists of Norwegian, Canadian, US and Russian scientists and is led by Nils Christian Stenseth at the University of Oslo in Norway. The aim is undertake comparative analysis of how climate variability and change, and biological interactions affect the spatial and temporal match-mismatch relationships in sub-Arctic marine ecosystems. TROPHARCT held its second meeting in Oslo in March 2011 to discuss progress on the papers that were outlined in the first meeting in the fall of 2009, i.e.

- The change of the age structure of the populations affects the population's susceptibility to climate.
- The loss of population structure affects the population's susceptibility to climate (e.g. the collapse of sub-stocks/spawning aggregations leads to a decline in the stock.
- Does cannibalism and/or predation "move" the critical stage in the life history?
- Warming leads to dominance of small/short lived and fast growing individuals of the same or different species.
- Exploitation of prey fish affects recruitment and/or population growth rate via maternal effects?

Drafts of the papers were presented and generated extensive debate and suggestions for improvements, additions and modifications. The papers will be published in a special section of MEPS. Deadline for the papers was scheduled for the autumn of this year.

12. Next Year's and Future Meetings

At the invitation of Yasunori Sakurai, the next annual ESSAS meetings will be held in Hakodate, Japan, in January of 2013. The over-arching theme of this meeting and potentially for ESSAS moving forward will be on "Climate effects on spatial dynamics of subarctic and

Arctic marine ecosystems". Japan has proposed a theme session on "*Fisheries Systems of Pollock and Cod: An Inter-disciplinary Approach in Arctic and Sub-Arctic Seas*". Sessions are expected from all Working Groups, as well as presentations on the human dimensions.

Appendix 1 – Participant Contact Information

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Appendix 1 – Participant Contact Information (Continued)

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<p>James E. Overland Pacific Marine Environmental Laboratory/NOAA 7600 Sand Point Way NE, Seattle, WA 98115-0070 Phone: (1-206) 526-6795 Fax: (1-206) 526-6485 E-mail: James.E.Overland@noaa.gov</p>	

Appendix 2 - ESSAS 2011 SSC Meeting Agenda

Scientific Steering Committee 2011 Annual Meeting
Marriott Waterfront Hotel, Seattle Washington, USA

Agenda

Friday May 27, 2011

09:00 Introduction and Adoption of the Agenda

- Future Direction of ESSAS
 - Working Group Status
 - WG 3
 - WG 4
 - Possible New Working Groups
 - Climate Variability
 - Arctic/Sub-Arctic Interactions
 - Human Dimensions
 - Others (?)
- Adoption of 2010 Meeting Report
- Follow-up from 2010 Meeting
- Follow-up from 2011 ESSAS OSM
- Funding
- SSC Membership

George Hunt/Ken Drinkwater
Open discussion
Open Discussion
Enrique Curchitser
Earl Dawe / Franz Mueter
Open Discussion
Jim Overland
Ken Drinkwater

Margaret McBride
Margaret McBride
George Hunt
Open Discussion
Ken Drinkwater

12:30 Lunch

13:30 Continued Discussion

15:00 International Program Updates

- Russia/Japan in the Sea of Okhotsk
- Canada/Norway in North Atlantic (NORCAN)
- USA/Norway in multiple areas (MENU&MENUII)

Yasunori Sakura
Erica Head
Drinkwater

17:00 Adjourn

Saturday May 28, 2011

09:00 National Program Updates

- Japan/J-ESSAS
- West Greenland
- Korea
- USA/BEST-BSIERP
- Canada
- Iceland/ISE
- Norway/N-ESSAR

Yasunori Sakurai
Kai Wieland
Sung-Ho Kang
Mike Sigler
Erica Head
Olafur Astthorsson
Ken Drinkwater

12:00 Lunch

13:00 Further Discussion

- Next year's meeting
 - Japan
 - Meeting Workshops & Objectives

15:00 Adjourn (no later than this time)